

FINDING OF NO SIGNIFICANT IMPACT
SECTION 206 ENVIRONMENTAL RESTORATION
ROSE BAY, VOLUSIA COUNTY, FLORIDA

I have reviewed the planning document and the Environmental Assessment (EA) for the proposed action. This finding incorporates by reference all discussions and conclusions contained in the Environmental Assessment attached hereto. Based on information analyzed in the EA, reflecting pertinent information obtained from cooperating Federal agencies having jurisdiction by law and/or special expertise, I conclude that the proposed action will have no significant impact on the quality of the human environment. Reasons for this conclusion are, in summary:

- a. There will be no significant impact on threatened or endangered species or sites of cultural or historic significance.
- b. Water quality standards will be met.
- c. Measures to eliminate, reduce or avoid potential adverse impacts to fish and wildlife resources will be implemented during project construction.

In consideration of the information summarized, I find that the proposed action will not significantly affect the human environment and does not require an Environmental Impact Statement.

Date

James G. May
Colonel, U.S. Army
District Engineer

Stodola/CESAJ-PD-ER/3453/als
McAdams/CESAJ-PD-EA
Dugger/CESAJ-PD-ER
Strain/CESAJ-PD-P
Duck/CESAJ-PD
Burns/CESAJ-DX
Peters/CESAJ-DD
May/CESAJ-DE

ENVIRONMENTAL ASSESSMENT

SECTION 206 ENVIRONMENTAL RESTORATION

ROSE BAY, VOLUSIA COUNTY, FLORIDA

1.0. Need for and Objectives of Action.

1.1. This report is submitted under the authority of Section 206, of the Water Resources Development Act (WRDA) of 1996, as amended. The act reads, in part, as follows:

“The Secretary may carry out an aquatic ecosystem restoration and protection project if the Secretary determines that the project- (1) will improve the quality of the environment and is in the public interest; and (2) is cost-effective.”

1.2. Rose Bay was once a major shellfish harvesting area, but as a result of poor water quality (organic sediments in particular) from inflows into the Bay and poor circulation created by two causeways, the Bay has filled with sediment and fish and wildlife productivity has decreased substantially. The north bank of the bay is highly urbanized; the drainage basin is comprised of a highly developed residential area of medium to high density. Most of this area was developed before 1980, has little or no stormwater treatment, and is served by on-site sewage disposal (septic system). Two existing causeways, the U.S. 1 causeway and an abandoned causeway, impede the tidal flow in and out of the bay. In 1994, with support from local interests and the Halifax/Indian River Task Force, the City of Port Orange, Volusia County, and the St. Johns Water Management District began planning and coordinating remedial actions that would restore the natural aquatic ecosystem of Rose Bay.

1.3. Corps responsibilities in the proposed restoration project are to dredge the excess mucky sediment overlaying historic benthic substrate from Rose Bay North, remove the abandoned U.S. Highway 1 (U.S. 1) causeway, and determine how much, if any, of the active U.S. 1 causeway needs to be removed in order to restore historic water circulation within the section of Rose Bay west of the old causeway. The Florida Department of Transportation (DOT) is currently building a second two-lane bridge adjacent to the first, and will be responsible for removing any of the existing U.S.1 causeway and replacing it with additional bridge.

2.0. Alternatives.

2.1. Alternative A, Dredging plus 0. Alternative A consists of dredging Rose Bay and removal of the old abandoned U.S. 1 causeway which lies to the east of the existing causeway. Muck will be removed from Rose Bay to a maximum depth of ten feet. The limits of dredging will start at the abandoned U.S. 1 causeway and extend through most of Rose Bay to a point approximately 500 feet east of the Florida East Coast railroad bridge, with a 1 on 10 transition (1 vertical on 10 horizontal) to the existing hard bottom.

The dredging will cover approximately 91 surface acres including Rose Bay and an area between the existing and abandoned causeway and remove approximately 225,000 cubic yards of mucky sediment (greater than 20 percent fines) from Rose Bay. The intent of the dredging is to remove as much of the mucky layer as possible without significant disturbance to the natural hard bottom to preserve its natural contour. An 8 to 10-inch, metal or plastic pipe will transport the excavated spoil from the dredge site to one or more temporary storage sites located along the southern shore of the estuary. These sites must have enough acreage to support containment dikes, staging of vehicles and equipment, and access roads. Depending on the method selected for spoil handling and de-watering, the size of the temporary spoil storage area may range from approximately 5 to 20 acres. Following de-watering, lined trucks will remove the material, if acceptable, off-site to an existing county landfill located approximately 10 miles from the project site. Removal of the abandoned U.S. 1 causeway by either a land-based or water-based operation will involve excavation of approximately 6,000 cubic yards of fill material. Due to the location of the causeway and its surrounding shallow water, a water-based operation may require special shallow-draft barges or dredging to accommodate deeper draft barges. A land-based operation may require construction of a temporary bridge to access the site.

2.2. Alternative B, Dredging plus 25. Alternative B includes all of alternative A with 25 percent removal of the length of the existing U.S. 1 causeway. The existing U.S. 1 causeway will be degraded to the thalweg of the bay from the southern bank and be replaced by a bridge built to the Florida Department of Transportation (FDOT) standards.

2.3. Alternative C, Dredging plus 50. Alternative C includes all of alternative A and 50 percent removal of the length of the existing U.S. 1 causeway. The existing U.S. 1 causeway will be degraded to the thalweg of the bay from the southern bank and be replaced by a bridge built to the Florida Department of Transportation (FDOT) standards. Alternative C is the preferred alternative.

2.4. Alternative D, Dredging plus 100. Alternative D includes all of alternative A and 100 percent removal of the length of the existing U.S. 1 causeway. The existing U.S. 1 causeway will be degraded to the thalweg of the bay from the southern bank and be replaced by a bridge built to the Florida Department of Transportation (FDOT) standards.

2.5. Alternative E. No Federal Action. With the no Federal action alternative, a project would not be implemented using Federal funds.

3.0. Existing Conditions.

3.1. Rose Bay is a natural, fully tidal estuarine embayment in central coastal Volusia County approximately 3.5 miles from Ponce De Leon Inlet and the Atlantic Ocean. The northern section of the bay, between the abandoned U.S. 1 causeway and F.E.C. railway bridge and causeway, is rectangular in shape, about 1 mile long, and 750 to 1000 feet in average width. The southern section, contiguous with the eastern end of the northern section, is broadly oval and surrounded by a mosaic of mangrove and salt marsh islands,

and lightly developed uplands. Fozzard, Mill, and Tenmile Creeks are the major meanders that hydraulically link Rose Bay with the main channel of the Halifax River. Some of these creeks, including the waterway connecting Rose Bay with Fozzard Creek, were previously dredged. Although generally separate from nearby Spruce Creek and Strickland and Turnbull Bays, during significant northeast storm events and other extreme high water conditions, water levels in Strickland and Rose Bay have risen sufficiently for a hydraulic connection to occur across their common boundary at Spruce Creek.

3.2. Historically, natural fresh water discharges into the northern section of Rose Bay were limited primarily to surface runoff from surrounding uplands, some subsurface flow from the surficial aquifer, through artesian discharge from the Floridian aquifer, or through three small creeks that drained freshwater wetlands. Construction of the Halifax, Cambridge, and Harbor Oaks Canals over the last 100 years, all of which discharge runoff and fresh groundwater into Rose Bay, have significantly increased the volume and rate of freshwater inputs into the system. Urbanization in the form of medium to high residential development north and west of Rose Bay over the last forty years has further accelerated freshwater intrusion into the bay through untreated stormwater runoff. Other discharge sources include the railway and highway bridges and causeways. These structures also have altered water circulation through their effect on tidal and wind-driven water flows. With the exception of some areas bordering U.S. 1, the land south of Rose Bay bordered by the F.E.C. railroad, U.S. 1, and Strickland Bay is largely in public ownership and undeveloped. Landforms within this area include uplands, intertidal wetlands, natural creeks, and man-made, open-water ditches and impoundments. This area is part of the Spruce Creek Preserve, and was acquired through the state Conservation and Recreation Lands Program.

3.3. Prior to 1900, the primary sources of sediment input into Rose Bay were surface runoff from adjacent uplands and detrital matter from small creeks draining salt marsh and freshwater wetlands. In its pre-development state, the composition of bottom substrate in north Rose Bay likely differed according to depth and location. Where wind and tide-driven water currents were strongest, local sediment inputs reduced, and depths relatively uniform, the benthic sediments likely consisted predominantly of sand/shell with or without a thin layer of overlaying organic material. Such conditions probably existed in the vicinity of the abandoned causeway and from the active causeway west approximately 1500 feet, primarily in the middle two-thirds of the bay. As the bay broadened, sediment inputs from adjacent intertidal marsh along the southern shoreline increased, and tidal influence decreased, the bottom sediments over the next 2000 feet likely contained a thicker layer of organic material and fines. This layer would likely have reached its maximum thickness in the westernmost 1000 feet of the bay, where depth, reduced current, and major gradual sediment inputs into the system favored the buildup of muck throughout the area. Less intense muck accumulation would have occurred along the shoreline of the rest of the bay, and in the deeper, steep-sided trenches and holes that characterize the area between the active and abandoned causeway.

3.4. In the last century, the combination of increased urban development, restricted water circulation, and the presence of drainage ditches have resulted in the excess transport of suspended solids into Rose Bay and their accumulation on bottom substrate throughout the estuary. These “muck” sediments are composed primarily of organic material mixed with various amounts of clay, silt, and sand. Nine north/south bathymetric and sediment sample transects across the entire length of Rose Bay north revealed muck present in every transect. Muck thickness ranged from 1.36 to 8.79 feet. In many locations, the muck accumulated to such an extent that those areas are exposed to air during mean low tides. The primary areas of accumulation correspond to areas of reduced water circulation. In addition to impacts on the benthic substrate, the quantity of suspended solids has reduced water clarity to a level considered a problem for the estuary, based on three years of sampling (1990-1993).

3.5. A sample of top and bottom water temperatures taken at the U.S. 1 bridge for an approximately 6-month period (May-Dec.) in 1994 did not reveal any unusual differences, with the average difference for the monitoring period only 0.66°C. In addition to seasonal differences, rapid inputs of fresh water into the system from the Cambridge, Halifax, and Harbor Oaks Canals during spring, summer, and fall also likely contribute to significant temporary changes in water temperature. These changes are expected to be more evenly distributed in the extreme shallow waters that occur in the western two-thirds of the bay’s northern section. In the eastern third, greater depths and generally higher tidal influences likely result in some stratification, particularly in the vicinity of freshwater inputs such as the causeways and Harbor Oaks Canal.

3.6. Cultural Resources. The earliest recorded settlement of the Port Orange area occurred in 1804. At that time, Patrick Dean was granted 995 acres by the Spanish Crown and constructed what was later known as the DunLawton Plantation. The plantation produced sugar cane and cotton, and included a stone mill worked by draft animals. DunLawton Plantation operated without much improvement until 1832, when the Anderson family acquired the property and added a steam powered sugar processing mill and brought 56 slaves to the site. In the late 1830’s, the DunLawton Plantation was the site of two battles with the Seminole Indians. It was not until 1842 that settlers would return to the Halifax area with any sense of safety. The Seminole War and the destruction of DunLawton had a severe impact on the area, which would later become Port Orange. The area remained virtually unoccupied except for the plantation, which was rebuilt in 1849.

3.7. After the Civil War, the area gained prominence with the founding of the Florida Land and Lumber Company by Dr. James Milton Hawks. This company and the people associated with it made a significant contribution to the foundering of Port Orange. Hawks, an abolitionist who is credited with coining the name of the area “Port Orange”, selected this location for the establishment of a settlement for freed slaves. The settlement was sited on the mainland near DunLawton Plantation, and Hawks’ sawmill and company lands were located on the peninsula in the area now known as Ponce Inlet.

3.8. The original Port Orange was, however, on the peninsula in the area known as Ponce Park. After the failure of the Florida Land and Lumber Company in 1867, the post office was relocated to the Allandale area, and later moved in 1868. From 1870 to the mid-1910s, Port Orange grew and prospered. The area was developing a reputation as a boat building town, with a strong economy based on oystering, fishing, farming, citrus, and boat building. During this time, Port Orange had a hotel, four stores, a post office, dozens of homes, a doctor, a few small boarding houses, and a cigar factory. In 1913, the area was incorporated as the Town of Port Orange with a population of 380. Port Orange remained a small community with a stable resort population throughout most of this century. Port Orange boomed into a larger metropolitan community with the construction of Interstate 95 in the mid-1970's.

3.9. Green Mound State Archeological Site is also located nearby. Green Mound is part of the St. Johns I and II cultural complexes. Green Mound is one of the larger shell midden of that period. Hunting, fishing, and collecting wild resources and occupying villages and camps adjacent to the numerous freshwater and coastal resources were the typical subsistence strategies. Green mound was occupied during a period of maximum population growth. The array of animals at these large coastal sites represent year round settlement. Animals eaten at these coastal sites included deer, turkey, raccoon, opossum, rabbit, wildcat, and a variety of fish, especially snook, mullet, shark, redfish and occasionally porpoise. Birds were also taken including loon, gannet, cormorant, duck, various gulls, pelicans, heron, ibis, and bald eagle.

3.10. Aesthetic Considerations. Consideration of aesthetic resources within the project study area is required by the National Environmental Policy Act of 1969 (NEPA) PL 91-190, as amended. Aesthetic resources are defined in ER 1105-2-100 as "those natural and cultural features of the environment which elicit...a pleasurable response" in the observer, most notably from the predominant visual sense. Consequently, aesthetic resources are (commonly referred to as) visual resources, features which can potentially be seen.

3.11. Rose Bay is a 72 acre body of water tidally connected to the Atlantic Ocean in the town of Port Orange, Volusia County, Florida. The water body is aesthetically pleasing to view and possesses good aesthetic value. Single family residential development borders Rose Bay on the north side and maintains the natural scale of the native vegetation of the area. Rose Bay is bordered to the south by Spruce Creek Park (within the Spruce Creek Preserve) that has wetlands, pine flatwoods and hardwood hammock vegetation. These vegetative characteristics of the preserve add interest as they reveal and conceal scenic marsh views. Low shoreline vegetation is prevalent along the preserve shoreline, which provides scenic views with good depth of field from the north side of Rose Bay. Utilities along the bay are virtually unnoticed with the exception of US Highway Route 1, which constricts and borders the bay to the east.

3.12. Elevated views of Rose Bay are afforded from the US 1 causeway of the bay, which provides a brief scenic view to the west and east as motorists cross the bridge. The scenic bay vista is concealed from the motorist until they traverse the causeway.

3.13. Rose Bay is an oblong water body that provides aesthetically pleasing foreground, mid-ground, and background scenic views. Views from the proposed project area are comprised of undeveloped open marsh vistas to the south of the bay and single family residential to the north of the bay. Views to the east are of the US 1 causeway with open marsh in the background. Background views to the west are of the meandering creek.

3.14. Recreation Considerations. Authority to consider Federal development of project-related recreation resources is contained in the Land and Water Conservation Fund Act (Public Law 88-578), the Federal Water Project Recreation Act (Public Law 89-72), and the Water Resources Development Act of 1986 (Public Law 99-662). The Corps' objective in terms of recreational development is to "fully consider the recreation potential that may be applied at Corps Civil Works Projects"(ER 1165-2-400).

3.15. The 72-acre natural coastal embayment is a body of water that offers shoreline and water-based recreation. Shoreline activities include birdwatching and bank fishing. Recreational boating and fishing also occur in the bay. Smaller boats can get under the US 1 causeway and out to the Intracoastal Waterway (IWW) and Ponce Inlet to the Atlantic Ocean. The potential for windsurfing and other water-based recreation activities (shrimping, crabbing, clamming, oystering, etc.) also exist in Rose Bay.

3.15. Essential Fish Habitat. Rose Bay serves as habitat for a wide variety of larval, juvenile and adult fish and crustaceans. Because of habitat degradation over the last several decades, the habitat value of Rose Bay has declined substantially. Because the purpose of the proposed project is environmental restoration, it has been determined that the proposed action will not adversely affect the essential habitat of species managed under the Magnuson-Stevens Fishery Conservation and Management Act (PL 94-265). The proposed action will in fact enhance the habitat for many of the affected species. Concurrence on this determination from the National Marine Fisheries Service has been requested pursuant to the above referenced Act.

3.16. Hazardous, Toxic and Radioactive Wastes. A Phase I Environmental Site Assessment was conducted in conformance with the scope and limitations of ASTM Practice E 1527; of the proposed dredged material disposal site located in Volusia County, Florida. The site visit, conducted 13 May 1997, found the site to be free of hazardous and toxic materials and waste. In summary, the proposed dredged material disposal sites were found to be free of any hazardous or toxic waste problems.

4.0. Environmental Impacts of the Proposed Action.

4.1. Physical. Historically, the various natural physical, mechanical, and biochemical processes helped maintain the chemical equilibrium of Rose Bay and its surrounding watershed. Ditching, development, and structural impediments to wind and water flow impacted these cycles to various degrees and consequently the chemical equilibrium. These factors, which accelerated input of such nutrients as nitrogen and phosphorous, heavy metals, and organic pollutants, can also affect the amount of oxygen available and

needed, as well as salinity. Water samples taken from 1991 through 1993 indicated that total nitrogen content in Rose Bay occurred at a level not considered to be a water quality problem, while total phosphorus did exceed its acceptable screening level. Muck samples taken in 1994 indicated that with the exception of cadmium, none of the heavy metals tested for in the samples exceeded the Threshold Effect Levels as outlined in the State of Florida's sediment quality assessment guidelines. Heavy metals omitted from that analysis included copper, nickel, tributyltin, and zinc. Information on the levels of organic pollutants and pesticides within water and sediment also is lacking. Limited sampling of dissolved oxygen (DO) levels between 1991 and 1993 indicated amounts within expected ranges. A 1994 sediment sampling of biological oxygen demand (BOD) yielded values ranging from 230-630 mg/kg. The levels of chemical oxygen demand (COD) within the estuary are unknown. Sampling of salinities in 1994 revealed seasonal as well as site variations across the bay, with relatively consistent, high levels occurring at sites closest to the mouth of the estuary and under the greatest tidal influences. Significant variations in salinities occurred at sites further removed from tidal inundation, as well as at sites subject to both continuous and intermittent freshwater discharges. Where these discharges coincided with little to no tidal influence sampled salinities were always less than 1.0 ppt.

4.2. Chapter 17-302 Florida Administrative Code, Surface Water Quality Standards, established several different types of classes or categories for water quality standards based on physical and chemical water attributes. The standards are based on ranges within the attributes, such as temperature and contaminants, that are not expected to impact human health or significantly degrade the natural resources within Florida surface waters. All surface waters in Florida are classified in one of five categories. Rose Bay is currently designated as a Class II water (suitable for shellfish harvesting and propagation). In addition, the state of Florida developed a Trophic State Index (TSI) that classifies water quality of lakes and estuaries based on chlorophyll content, water clarity as measured by Secchi depth, and total nitrogen and phosphorous concentrations. Based on water sample data collected from 1991-1993, the calculated TSI for Rose Bay was 56, which places it in the "Fair" water quality category for estuaries. Data on historic and present abundance and distribution of shellfish within Rose Bay is lacking. The presence of crab pot buoys observed during field trips to the site suggests that blue crabs (*Callinectes sapidus*) still occur within Rose Bay. Field trips also revealed the presence of scattered oyster (*Crassostrea virginica*) aggregations near the abandoned causeway. The presence and location of other aggregations or beds is unknown. The excessive turbidity and mucky sediments within Rose Bay likely have had adverse impacts on the growth, survival, and abundance of the hard clam (*Mercenaria mercenaria*). Due to elevated levels of coliform bacteria in the water column, harvesting of oysters and clams from Rose Bay has been prohibited for over 40 years. As a result, Rose Bay only partially meets its Class II designated use.

4.3. Rose Bay, along with Spruce Creek, Turnbull Bay and Strickland Bay to the south of Rose Bay are designated Outstanding Florida Waters. This state designation refers to water bodies having either exceptional recreational or ecological significance, and which

are afforded a high degree of protection corresponding to a level of “no significant degradation”. These waters have historically been valued as habitat for shell fish.

4.4. The presence and effects of trace metals in organisms within Rose Bay is unknown. Trocine and Trefry used the filter-feeding hard clam (*Mercenaria mercenaria*) to evaluate bioaccumulation within the adjacent Indian River Lagoon system. Though limited, the results of their study suggested that, with the exception of copper in the Titusville area, metal levels in tissues of hard clams taken from the central Mosquito Lagoon to the Indian River around Titusville, in general did not appear to be at levels known to cause damage to clams.

4.5. The proposed work is expected to have the following temporary and permanent impacts to the chemical environment. A temporary increase in nitrogen, phosphorous, organic and inorganic contaminants, BOD, and possibly COD is expected within the water column during and after dredging. The post-dredging duration of this increase is not known, although likely it will vary according to water depth, bottom profile, and tidal velocity. Major long-term reductions in nutrient and pollution load within the bottom sediment, with less significant reductions of such chemicals in the water column is expected.

4.6. Some reduction in BOD, possibly COD, and a possible general increase in DO, or at least a decrease in the intra-seasonal variation in DO as a result of enhanced circulation and a larger water volume should also occur. A decrease in intra-seasonal variation in salinity and an increase in the extent of estuarine salinities, particularly in the western 25 percent of the bay, and the drainage canals is expected.

4.7. Biological.

4.8. Detailed studies on the biological diversity within Rose Bay are lacking. Historically, Rose Bay supported a significant shellfish harvest. More recent surveys of Ponce De Leon Inlet and associated estuarine waters found these habitats supporting a rich species assemblage that is dominated by a few taxa. The diversity of the estuarine system near Ponce de Leon Inlet is typical of Florida's warm water estuaries. However, limited sampling of benthic invertebrates within Rose Bay, in the Halifax River near Daytona Beach, and less impacted aquatic habitats associated with the surrounding estuary in 1997 revealed a generally lower overall diversity in Rose Bay and the Daytona Beach sites than the other sites. This result is in agreement with findings for the Indian River Lagoon system that overall diversity generally is higher near inlets and undeveloped coastal areas compared to areas adjacent to intense coastal development or subject to non-point source discharges.

4.9. The following descriptions of general habitats and specific vegetative associations follow the land-use categories provided in the Florida Land Use, Cover and Forms Classification System. Where applicable, Levels I-III classification codes are provided in parentheses next to the descriptions. General habitats within the affected environment include open water (500), submerged bottom substrate (benthos) (500), wetlands (600),

and upland forests (400). Specific biotic communities/ vegetative associations within these habitats include microbes and plankton (512), open-water macrofauna (512), benthic invertebrates (512, 654), submerged aquatic vegetation (645), tidal mud flats (651), salt marsh (642), freshwater marsh(641), temperate hardwood forests (425) and pine flatwoods (411).

4.10. Microbes (400, 500, 600) and Plankton (512). Bacteria and fungi are present in all habitats within the project area. In addition to their natural decomposing roles, the types and actions of these organisms affect water chemistry and quality. Microbes also serve as prey at the base of the aquatic and terrestrial food web. The levels of coliform bacteria in project waters have increased as a result of construction of the storm water drainage canals and intense residential and light commercial development in the northern and western sections of the Rose Bay watershed. Their abundance has resulted in a closing of shellfish harvesting and cautions regarding other water-related recreational activities. This closure currently remains in effect.

4.11. Phytoplankton are one-celled or simple colonial-celled plants occurring in open-water habitat that are often too small to see with the naked eye. Their presence is often indicated by the green color that their chlorophyll imparts to the water column. Phytoplankton are a key base component of the estuarine food web. Too much phytoplankton, however, can adversely affect water chemistry, causing fish kills. Their abundance can decrease light penetration and adversely impact seagrass production. Light levels, temperature, and nutrient levels affect abundance and photosynthesis.

4.12. Zooplankton make up the animal portion of the microscopic floating community and include copepods, tintinnids, foraminiferans, polychaete larvae, radiolarians, shrimp, chaetognaths, and the larval stages of bivalve mollusks. Zooplankton feed on phytoplankton and in turn are feed upon by larger animals, particularly larval, juvenile, and even some adult stages of fish, such as the bay anchovy (*Anchoa mitchilli*), menhaden, (*Brevoortia* spp.) and tidewater silversides (*Menidia peninsulae*).

4.13. Ichthyoplankton include fish eggs and larval fishes that float in the water column. Larval fishes feed on zooplankton. Information on ichthyoplankton and other planktonic communities within Rose Bay and the surrounding estuarine habitats is lacking.

4.14. The proposed work is expected to have the following temporary and permanent impacts to microbes and the planktonic community. Some reduction in coliform bacteria levels both in the water column and bottom sediment should occur as a result of removal of bacteria-laden substrate and enhanced water circulation. There will likely be an increase in plankton at all trophic levels due to increased water clarity, circulation, and volume, stabilization of nutrient inputs, and decreases in potentially toxic compounds.

4.15. Open-water Macrofauna (512). Fauna associated with open waters in and around Rose Bay include fish, birds, reptiles, and mammals. The dominant finfish taken in seine and trawl samples over a four-year period (1993-1997) from the nearby Halifax River, North Indian River, and other waters within six miles of Ponce De Leon Inlet were

anchovies (Engraulidae), mojarra (Gerreidae), spots, croakers, and red drum (Sciaenidae), silversides (Antherinidae), menhaden and sardines (Clupeidae), killifish (Cyprinodontidae), mullet (Mugilidae), gobies (Gobiidae), and pinfish (Sparidae). Somewhat similar assemblages, though in different orders and abundances, occurred in Lost and Tenmile Creeks. Other species of commercial or recreational importance recovered in the survey include snook, sea bass, spotted seatrout, kingfish, flounder, bluefish, pompano and permit. Birds such as terns, gulls, the osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), brown pelican (*Pelecanus occidentalis*), double-crested cormorant (*Phalacrocorax auritus*), and various waterfowl feed within the open waters of Rose Bay. Reptiles that may occur within Rose Bay include the diamondback terrapin (*Malaclemys terrapin tequesta*) and the federally listed threatened loggerhead (*Caretta caretta*), and endangered green (*Chelonia mydas*) and Kemp's ridley (*Lepidochelys kempii*) sea turtles. The occurrence of sea turtles likely are tied to the availability of their prey items; various crustacea and aquatic vegetation. Mammals that may occur within the easternmost section of Rose Bay are the federally endangered Florida manatee (*Trichechus manatus latirostris*) and Atlantic bottlenose dolphin (*Tursiops truncatus*). Water depths west of the active causeway in general appear too shallow to permit significant access for either the manatee or dolphin. Although not federally listed, the bottlenose dolphin is protected under the Marine Mammal Protection Act. It apparently occurs within the North Indian and Southern Halifax Rivers during the summer months, where it feeds on a variety of fishes. Because of the deep waters associated with these waterbodies and portions of the adjacent Ponce de Leon Inlet, these species may remain in the area during the winter months.

4.16. The proposed work is expected to have the following temporary and permanent impacts to open-water macrofauna. Temporary loss of some finfish due to removal by the suction dredge and possible mortality due to increased turbidity from suspended sediments resulting from the dredge operation may occur.

4.17. A loss of approximately 36 surface acres of shallow-water (< -1.1 foot MLW), mud-bottomed habitat west of the active causeway and favored by silversides, killifish, mosquitofish, mullet, some species of gobi, and some waterfowl will occur.

4.18. There will be a gain of approximately 55 acres of medium depth waters west of the active causeway, having a primarily sand-bottom habitat and favoring anchovies, menhaden, herring, other various commercial and recreational finfish, the Florida manatee, and Atlantic bottlenose dolphin, osprey, eagle, brown pelican, cormorant, terns, gulls, and other species of waterfowl.

4.19. There will be a gain of approximately 28 acres of mainly deeper waters between the active and abandoned causeway, having a mixed bottom substrate and favoring larger finfish, aquatic mammals, and possibly sea turtles.

4.20. Benthic Invertebrates (512, 654). Benthic organisms include species living on top of the substrate (epifauna), and those living underneath the surface (infauna). The dominant organisms within the benthic community of the Indian River Lagoon include

polychaete (segmented) worms, crustacea such as amphipods, isopods, crabs, and shrimp, and molluscs such as snails and clams over vegetated as well as unvegetated substrate. These communities naturally may vary substantially over time and space. Benthic organisms play an important role in the IRLS, as they likely did historically within Rose Bay, serving as prey for higher animals, providing a commercially valuable resource, and converting plant and detrital material into forms available to higher level consumers. In addition, oyster reefs provide habitat for smaller fish, annelid worms, and crustaceans (Zimmerman *et al* 1989, Coen *et. al* 1998). Commercially important shellfish include the hard clams (*Mercenaria mercenaria* and *M. campechiensis*), Eastern oyster (*Crassostrea virginica*), and blue crab (*Callinectes sapidus*). Although the historic abundance and distribution of oyster bars (654) within Rose Bay is unknown, based on a site visit by the U.S. Fish and Wildlife Service to the project area and similar, though less impacted estuaries immediately south of Rose Bay, it is likely that the current oyster population within the project area is considerably less than what occurred in the bay prior to local development and excavation of storm water canals.

4.21. A limited survey of Rose Bay and the surrounding Halifax River system, Kent found that the average number of benthic species occurring within Rose Bay and other impacted sites within the Halifax River and adjacent to Daytona Beach was 9.7. At less disturbed sites in the Halifax River, Turnbull Bay, and the Mosquito Lagoon, species diversity was significantly higher (16.3). The dominate species from Rose Bay and the other impacted sites were *Streblospio benedicti* and *Capitella capitata*, polychaete worms that are pollution tolerant and opportunistic in stressed or disturbed areas. A clam (*Mulinia lateralis*), polychaete worm (*Mediomastus ambisetae*), and amphipod (*Corophium ascherusium*) were dominant at each of the other three sites. Trawl and seine samples at fixed stations within the Ponce De Leon Inlet estuarine drainage basin near Rose Bay during 1997 revealed the dominant epifaunal organisms to be the blue crab (*Callinectes sapidus*) and the commercial species of penaeid shrimp: brown (*Farfantepenaeus aztecus*), pink (*F. duorarum*), and white (*Litopenaeus setiferus*). A comparison of closed and open estuarine creeks near Rose Bay revealed the bottom sediments in the closed creek (Lost Creek) averaged 25 per cent sand, 75 per cent mud, and 17 per cent organic matter, while the open creek (Ten Mile Creek) averaged 95 per cent sand, 5 per cent mud, and 3 per cent organic matter. Both sites supported a similar assemblage of macro epifaunal crustaceans (blue crabs, penaeid shrimp, grass (*Palaemonetes* spp.)shrimp), with Lost Creek supporting greater individual numbers. The highest diversity of microbenthic fauna at Ten Mile Creek (47) was as much as twice as high as that in Lost Creek (23), although total individual numbers, based primarily on a few dominant groups, favored Lost Creek. Of special significance was the almost complete lack of molluscs, and with one exception, amphipods, within Lost Creek. Water quality samples during the same period revealed consistently higher salinities, and total nitrogen, phosphorous, and suspended solids levels, as well as higher turbidity, at Lost Creek. Most, if not all, of the differences were statistically significant for these various water quality parameters.

4.22. Although on a smaller scale, many of the physical, chemical, and biological conditions in the two creek systems in the preceding study likely mimic the existing and

future conditions in Rose Bay following aquatic habitat restoration. With respect to the benthic community, commercial shellfish are of particular significance, due to their status as indicators of estuarine water quality classification. In addition, the rare Spruce Creek snail (*Melongena sprucecreekensis*) a predatory gastropod apparently restricted to estuaries just north and south of the Spruce Creek drainage, feeds exclusively on oysters. Its density, distribution, and survival is a function of the presence of oysters, muddy substrate, and water depth.

4.23. The Eastern oyster naturally ranges along the coast of North America from the Gulf of St. Lawrence to the Gulf of Mexico. Adult and juvenile oysters, called spats, are immobile, while the two larval stages are free-swimming. Although growth, development, reproduction, and feeding can occur over a wide range of environmental conditions, adverse effects can occur due to extremes in some of the physical and chemical habitat parameters. Eggs, larvae, spats, and adults are generally very tolerant of natural extremes in temperature and dissolved oxygen. Salinities less than 5 ppt are deleterious to all life stages, while normal growth requires salinities of 12.5 ppt. and above. Rapid changes in salinity extremes apparently have little effect. Optimal salinity conditions for growth and development of the immature stages are influenced by the salinity experienced by the parents during gametogenesis. Reduced salinities reduce the temperature range that eggs and larvae could tolerate for development and growth. Oyster eggs and larvae may be killed by excessive concentrations of suspended sediments. The effects on pumping and food filtration of adults apparently depends on local natural sediment loads. Oysters from naturally low sediment waters fed most efficiently at low sediment concentrations. Such oysters ceased feeding at high sediment loads. Oysters occurring in naturally turbid waters were capable of feeding rapidly in the presence of heavy loads of suspended sediment. Oysters survive best on firm, stable bottoms. Shell, rock, and firm or sticky mud are suitable substrates. Shifting sand bottoms can abrade and injure oyster valves, as well as potentially destroying young spat. With respect to contaminants, heavy metals such as mercury, silver, copper and cadmium are acutely toxic to oyster adults and larvae at relatively low concentrations. Chronic exposure to tributyltin and petroleum hydrocarbons can also cause adult oyster mortality. Certain chlorinated pesticides, polychlorinated biphenyls (PCB's) and polynuclear aromatic hydrocarbons (PAH's) caused acute mortality or sublethal effects in juvenile oysters at relatively low concentrations.

4.24. The following information on the hard clam is excerpted from Roegner and Mann (1991). The hard clam naturally occurs along both the Atlantic and Gulf coasts of North America from the Gulf of St. Lawrence through Texas. Its depth range extends from the intertidal zone to greater than 60 feet. The adult and juvenile stages, though not immobile, are generally sedentary, while all larval forms are mobile and free-swimming. Like the Eastern oyster, growth, development, reproduction, and feeding are temperature dependent, but usually not limiting within the range of normally encountered, local temperatures. Hard clams of all life stages are tolerant of low levels of dissolved oxygen, although growth rates can be reduced. Salinity is a major factor in the growth, survival, and distribution of the hard clam. Adult hard clams generally cannot exist in waters with salinities below 12 ppt, and reproduction is inhibited below 15 ppt. The salinity range for

normal egg development is 20-35 ppt, with an optimum of about 27 ppt. High mortality occurs at less than 12-17 ppt. Although larval development can occur between 15-35 ppt, metamorphosis is inhibited at less than 17 ppt. Optimum salinity for growth and survival to settlement is 26-27 ppt. The combination of high temperatures and low salinities can further inhibit larval growth and produce higher larval mortalities. Heavy sediment loads, especially those encountered during dredging or heavy runoff events, can have negative effects on growth and survival. High concentrations of small particles can clog the alimentary tract of larvae, depress the rate of filtration and algae ingestion in both juvenile and adult clams. Although hard clams are capable of living in a variety of sediment types, field surveys generally revealed more clams in sandy than muddy substrates. Larvae prefer to settle in sand over mud, and growth rates are higher in sand substrates. With respect to contaminants, embryos and larvae are much more susceptible to toxicants in general than adults. Heavy metals such as mercury, copper, silver, and zinc are especially toxic to clam eggs and larvae, while adult and juvenile clams are most susceptible to, in decreasing order, copper, cadmium, chromium, and zinc. Petroleum hydrocarbons are very toxic to embryonic and larval clams, and decrease growth rates in juveniles and adults. Responses to pesticides were variable, with toxicity generally greater for larvae than eggs, and causing stress in juveniles and adults. Embryos and larvae have relatively low tolerances for surfactants, with tributyltin and chlorine found to be highly toxic to eggs and larvae.

4.27. In the United States, the blue crab naturally occurs along both the Atlantic and Gulf coasts, reaching greatest abundance from New Jersey through Texas. Crabs utilize a variety of shallow and deeper water habitats, ranging from open ocean waters to tidal fresh waters, depending upon life stage and cycle. All life stages are mobile, with the larval stages developing off-shore and post-larvae and early juveniles returning to estuarine waters in late summer and fall. Blue crabs are both predators and scavengers, with bivalves, other crabs and crustaceans, fishes, plant matter and detritus making up the bulk of their diet. Other prey items include ostracods, insect larvae, polychaete worms, mysids, and amphipods. Prey selected appears to be a function of size, with the drifting larval stages foraging largely on other zooplankton. Although blue crabs occur in a variety of temperatures; their mobility allows them to seek preferred temperatures. Juveniles especially are less tolerant of low temperatures and salinities, which accounts for their migrations to deeper waters and mud burrowing activity as water temperatures drop. Blue crabs generally avoid areas with low (<2 ppm) or no dissolved oxygen, at times leaving the water to escape anoxic conditions. Adults and juveniles are most abundant in waters of intermediate salinity, but can be found from ocean strength salinities to freshwater. Larvae cannot survive in salinities less than 20 ppt. The effects of turbidity and suspended sediments are unknown. Bottom substrate does not appear to influence distribution, although sea grass beds are important nursery habitats for juvenile blue crabs as well as molting sites. Where sea grass is lacking, salt marsh subject to frequent and prolonged inundation supported more crabs than were found on bare sand and mud bottoms of marsh creeks. These creeks, however, served as important molting sites and travel corridors. With respect to contaminants, varying acute toxicities were observed for larval, post-larval, and juvenile crabs exposed to cadmium, chromium, selenium, and mercury at various levels and salinities. Blue crabs are tolerant of

petroleum hydrocarbons, PAH's and PCB's. They tend to bioaccumulate the latter two organic contaminants. Adult blue crabs are relatively tolerant of such pesticides as kepone, mirex, malathion, and DDT. Juveniles and the various larval stages demonstrated variable responses, ranging from acute toxicity to sublethal effects on growth, development, and behavior. Adult blue crabs also are tolerant of halogenated compounds, including levels of chlorinated sea water only rarely expected in the environment near outfalls.

4.28. The proposed work is expected to have the following temporary and permanent impacts to the benthic invertebrate community. The immediate removal of all infauna and less mobile epifauna, and temporary displacement of more mobile epifauna will occur in dredged areas. Dredging will create a mosaic of benthic habitats and result in an immediate change in certain physical and chemical parameters within the bay that favor natural colonization, establishment, survival, growth, development, and reproduction of commercially valuable shellfish and other common and rare benthic invertebrates. Dredging will also cause a gradual and permanent change in the existing assemblage of benthic species and overall increase in species diversity.

4.29. Submerged Aquatic Vegetation (645) – Algae. Submerged aquatic vegetation (SAV) includes algae and seagrasses. SAV perform such diverse functions as stabilization of sediments, prevention of re-suspension of particulate matter, and providing cover and food for fish and wildlife.

4.30. The two major types of macroalgae are drift and attached algae. Epiphytic algae are tiny rootless plants occurring on substrates like rocks or leaves of other plants such as seagrasses. The extent of past or current presence of either type of algae within Rose Bay is unknown. However, the current high turbidity and amount of total suspended solids in Rose Bay does not favor either drift or attached algae due to reduced water clarity. South of Rose Bay, within the Indian River Lagoon, a total of 63 species of drift algae were identified. The dominant genera and species included *Acanthophora spicifera*, *Chondria tenuissima*, *Dictyota dichotoma*, *Gracilaria* spp., *Hypnea cervicornis*, *H. musciformis*, and *Spyridia* spp. Attached algae can occur at a wide range of depths, and have been reported in deep channels. Most species require hard substrates, such as rocks, pipes, and fish traps, for attachment. *Caulerpa prolifera* is the most documented species within the system. *C. prolifera* has short, ribbon-like leaves similar to some seagrasses. Unlike other attached algae, this species appears to spread by underground rhizomes, and can spread rapidly in soft, sandy substrates. This algal group is an important food source for various small invertebrates such as snails, amphipods, copepods, and shrimp.

4.31. Submerged Aquatic Vegetation (645) – Seagrasses. Seagrasses are totally submerged, rooted angiosperm plants with vascular systems that reproduce by seeds and/or rhizomes. The historic distribution of any seagrasses within Rose bay is unknown. If any did occur within the project area, the current high turbidity and amount of total suspended solids in Rose Bay would likely have affected their growth and reproduction. Species whose range encompasses Rose Bay include shoal grass (*Halodule wrightii*) and

widgeon grass (*Ruppia maritima*). Shoal grass has narrow (0.1 inch), ribbon or strap-shaped leaves that are unbranched. It reproduces most commonly from rhizomes and is most abundant in waters between 1.6 to 3.3 feet. Widgeon grass resembles shoal grass, but the flat, alternate leaves generally are slightly narrower and tapered at the ends. Widgeon grass sometimes has branched stems with many leaves emanating from a single stem. Widgeon grass readily reproduce from seeds. It generally occupies the same habitat as shoal grass, but is more tolerant of lower salinities than shoal grass.

4.32. The proposed work is expected to have the following temporary and permanent impacts to SAV. A permanent improvement in water clarity, circulation, and substrate foundation that favors the presence and growth of drift algae and possibly attached algae is expected. Creation of habitats suitable for the natural colonization or artificial introduction of shoal grass and widgeon grass will also occur as a result of dredging.

4.33. Intertidal Wetlands - Salt marsh (642). Salt marsh is one of two major types of intertidal wetlands associated with Rose Bay. Salt marsh exists in varying widths along the southern, western, and northwestern boundaries of the bay. The wider sections generally correspond to natural intertidal drainages that are subjected to both increased fresh or salt water inundation as a result of stormwater canals, and mosquito ditches and impoundments. Salt marsh transitions into brackish marsh west and north of the F.E.C. train trestle. The drainages along the southern boundary extend to Spruce Creek. Both high and low salt marsh occur within the project area. The low marsh consists primarily of smooth cordgrass (*Spartina alterniflora*) and glasswort (*Salicornia virginica*), where the high marsh supports a greater diversity of flora such as black needlerush (*Juncus roemerianus*), salt meadow cordgrass (*Spartina patens*), saltwort (*Batis maritima*), salt grass (*Distichlis spicata*), sea ox-eye (*Borrchia frutescens*), sea blite (*Suaeda linearis*), coastal dropseed (*Sporobolus virginicus*), and salt marsh fimbristylis (*Fimbristylis castanea*). The upper edges of the high marsh and the brackish marsh support woody species such as high-tide bush (*Iva frutescens*), Christmas-berry (*Lycium carolinianum*), and groundsel bush (*Baccharis halimifolia*).

4.34. Intertidal Wetlands - Non-vegetated flats (651). Tidal mud flats occur along the entire perimeter of the bay, as well as across most of the western 40 percent of the bay. The latter distribution is the result of excess sediment carried by the Cambridge and Halifax stormwater drainage canals and deposited as a result of the altered water circulation resulting from the two causeways. Depth of the flats range from less than a foot to over five feet in some locations.

4.35. Scattered plants and small stands of black (*Avicennia germinans*) mangrove occur within the salt marsh, on the abandoned causeway, and intertidal islands within the western portions of the bay. White (*Laguncularia racemosa*) and possibly red (*Rhizophora mangle*) mangrove also may occur within the project area. Intertidal wetlands support a variety of vertebrate and invertebrate fauna. Lists of species and descriptions of assemblages that occur or may occur within the project area may be found in the Petition for Designation of Spruce Creek as an Outstanding Florida Water, Tomoka Marsh Aquatic Preserve Management Plan, and Biological Resources of the Indian River

Lagoon, Vol.1. In addition, the project site is within the range of the federally listed Atlantic salt marsh snake (*Nerodia clarkii taeniata*).

4.36. The proposed work is expected to have the following temporary and permanent impacts to intertidal wetlands. There will be a permanent loss of less than 1 occupied acre of scattered mangroves associated with removal of the old U.S. 1 causeway and replacement of all or portions of the existing causeway. A permanent loss of mud flats totaling approximately 40 per cent (36 surface acres) will occur in the center of the Bay within the western half of the project footprint. Project construction will also result in a permanent reduction in feeding and loafing habitat available for wading birds, shorebirds, and certain waterfowl, and reduction in feeding habitat for select finfish.

4.37. Construction of temporary disposal areas and pipeline right-of-way will cause the temporary loss of approximately 7.5 acres of a predominantly high salt marsh community within the footprint of the temporary spoil disposal site and dredge pipeline. There will also be temporary impacts to drainage patterns within portions of the salt marsh resulting from the proposed temporary spoil disposal activities.

4.38. Freshwater Marshes (641). Site visits by the U.S. Fish and Wildlife Service and a review of the U.S. Fish and Wildlife Service's National Wetlands Inventory map (New Smyrna Beach 7.5 Minute Series Quadrangle) revealed two small herbaceous marshes, totaling less than two acres, in the middle of mesic pine flatwoods located at the southwestern corner of the bay. Their dominant vegetation included cattail (*Typha* spp.) and St. Johns-wort (*Hypericum* spp.). These marshes were burned as a result of a wildfire in 1998.

4.39. Temperate Hardwood Hammocks (425) and Pine Flatwoods (411). Natural major upland communities within the project area include temperate hardwood hammock, also known as maritime forests, and pine flatwoods. Other uplands include portions of the active and abandoned U.S. 1 causeways. Maritime forest is the dominant community within uplands contiguous with and west of U.S. Highway 1, along the southern border of Rose Bay. This forest gives way to a mix of oaks and pine flatwoods in three isolated uplands located west of the easternmost upland. The two upland islands closest to U.S. 1 also support dense stands of the exotic Australian pine (*Casuarina equisetifolia*) (437). Pine flatwoods predominate in the westernmost upland area, located in the southwest corner of Rose Bay.

4.40. The canopy within the maritime forest includes such species as live oak (*Quercus virginiana*), sand live oak (*Quercus geminata*), laurel oak (*Quercus hemisphaerica*), slash pine (*Pinus elliotii*), cabbage palm (*Sabal palmetto*), pignut hickory (*Carya glabra*), red maple (*Acer rubrum*) and southern magnolia (*Magnolia grandiflora*). Understory species include red bay (*Persea borbonia*), southern red cedar (*Juniperus silicicola*), yaupon (*Ilex vomitoria*), wax myrtle (*Myrica cerifera*), and buckthorn (*Bumelia tenax*). The dominant ground cover is saw palmetto (*Serenoa repens*). Slash pine and saw palmetto are dominant in the major flatwoods habitat. Also present are scattered runner oak

(*Quercus pumila*) and a stand of sand live oak and coontie (*Zamia floridana*) adjacent to the shoreline. The area within the project footprint experienced a wildfire in 1998.

4.41. Faunal lists and descriptions of species assemblages that occur or may occur within the project area may be found in the Petition for Designation of Spruce Creek as an Outstanding Florida Water, Tomoka Marsh Aquatic Preserve Management Plan, and Biological Resources of the Indian River Lagoon, Vol.1.

4.42. The proposed work is expected to have the following temporary and permanent impacts to natural and created uplands. A permanent loss of flora, sessile and slow-moving fauna, and faunal habitat associated with the abandoned causeway and one or more portions of the existing causeway will occur as a result of construction activities. There will be a temporary loss of flora, sessile and slow-moving fauna, and faunal habitat associated with approximately 4.4 acres of high quality maritime hammock within the footprint of the access road to the proposed spoil disposal site, as well as a temporary loss of flora, sessile and slow-moving fauna, and faunal habitat associated with approximately 5.5 acres of moderate quality upland hardwood forest within the eastern footprint of the proposed temporary spoil disposal site.

4.43. There will be a permanent loss of flora, sessile and slow-moving fauna, and faunal habitat associated with approximately 1.5 acres of two Australian pine stands within the eastern footprint of the proposed temporary spoil disposal site.

4.44. Hydrodynamic Model. A hydrodynamic analysis was conducted to characterize water flow and circulation within the project footprint under existing conditions, and compare the characteristics to those projected to occur as a result of various physical modifications to the active and abandoned U.S. 1 causeways. The RMA-2 model used for the analysis computed water surface elevations and horizontal velocity components for subcritical, free-surface flow in two dimensional flow fields. The model simulations were based on a semi-diurnal tidal cycle for a 48-hour period. The amplitudes of the tides used were +0.9 feet for Mean High Water (MHW) and -.27 feet for Mean Low Water (MLW). The model incorporated 15 “gauges” and 5 flux “lines.” The resulting information produced normal and peak flows at each line. The average and peak velocities at the gauges were computed, as well as the velocity vector plots for the peak out going tide. Tidal “flushing” of the subject area was computed using the RMA-4 water quality model that employs a two-dimensional advection diffusion equations for conservative and decaying constituents. The model provided an indication of the embayment’s flushing by looking at the “mixing rate” of the subject area for the various model runs, using a theoretical contaminant constituent.

4.45. The relative flushing from the model simulations suggest that the various alternative modifications to the active and abandoned causeways have little to no effect on flushing time. The major factor affecting the flushing time within the embayment among current and alternative conditions is the dredging. The increased volume of the embayment results in an overall slower flush time for all hypothetical concentrations. The differences in time appear proportional when the theoretical contaminant

concentration is approximately 50%. Because the flushing model used the output solution from the original RMA-2, depth-averaged model, however, actual flushing rates at various locations within the embayment will vary according to local depths.

4.46. The ecological significance of overall increased flush time is a greater temporal stabilizing of physical and chemical conditions within Rose Bay. If excessive point source inputs, such as freshwater and total suspended solids, and non-point source inputs such as leaking septic systems, are reduced or eliminated, the increased stability of more natural environmental conditions should favor the growth, reproduction, and survival of both open water and benthic aquatic organisms.

4.47. An increase in the primary productivity in Rose Bay would also be expected from an increase in the number and duration of phytoplankton entering and remaining in the embayment. Likewise, the expected increase in number of zooplankton and ichthyoplankton, and the duration spent within Rose Bay, should enhance the establishment of those species having planktonic life stages, as well as be an attractant to other organisms at higher trophic levels.

4.48. In general, water flow and circulation within the western portion of Rose Bay are not significantly altered by the proposed alternative modifications. Existing conditions within east Rose Bay are represented by alternate areas of highly concentrated and diffuse water velocities, primarily associated with, or resulting from, the existing and abandoned causeways. Dredging, and the removal of the old causeway (Alternative 1) significantly improves the circulation north and south of the causeway, as well as producing less intense, more uniform water velocities east and west of line 4, and the northern portion of south Rose Bay. These improvements are retained in Alternative 2, with the added benefits of reducing velocities in the vicinity of the existing bridge, and adding significant circulation to formerly diffuse flow areas east and west of the existing causeway. Alternative 3 adds further circulation east of the active causeway, while creating more uniform velocities both north and south of the remaining embankment. With 100% embankment removal (Alternative 4), an additional, though smaller, incremental improvement is seen in water circulation and uniform water velocity in the vicinity of the removed embankment and near both shores of the active causeway. Higher water velocities in the vicinity of the ends of the removed, abandoned causeway persist. These velocities are likely the result of the shoreline configuration in that area, as well as the expected change in depth between north and south Rose Bay in the vicinity of the old causeway.

4.49. The hydrodynamic model predicts improvements in water circulation, and dampening of areas of intense water velocity for all the alternatives. This result agrees with a previous hydrodynamic model for Rose Bay by Marshall, Provost and Associates. While Alternative 2 provides the greatest incremental benefit, benefits not measured by the model include further enhanced local water circulation resulting from lessened wind resistance due to removal of the causeway, and the addition of bottom structure in the form of bridge, that can act as substrate for various aquatic plants and epifauna. This in turn will attract larger, open- water aquatic organisms. As a result of these further

benefits, Alternatives 3 or 4 are the ones that will most likely provide the maximum ecological benefit.

4.50. Cultural Resources. A cultural resources survey was conducted in 2001. This survey combined both surface and subsurface methods and resulted in the identification of a mid-20th century structure (8VO7222, known as the Rose Bay Shack) at the disposal site. The survey also identified the presence of the Rose Bay causeway (8VO7195) which was part of the Old Dixie Highway and which is proposed for removal. The Rose Bay Shack has been determined as not eligible for the National Register of Historic Places. The Rose Bay Causeway has been determined to be eligible for the National Register. Based on the survey and site evaluations, in accordance with procedures contained in 36CFR800, consultation between the Jacksonville District and the Florida State Historic Preservation Officer is in progress. A determination of eligibility for the Rose Bay Causeway is expected. Based on the development and implementation of a mitigation plan for the Causeway a determination of no adverse impact is expected.

4.51. With Project Conditions. The with project conditions could improve the aesthetics of Rose Bay by removing muck, increasing circulation and providing a healthier ecosystem. This could improve olfactory characteristics of the bay in the heat of the summer.

4.52. Proposed dredged material dewatering/disposal areas are planned to use the upland pine flatwood areas. The smaller flatwoods area contains exotic tree species and possesses diminished aesthetic resources when compared to the larger flatwoods area to the west. The temperate hardwood hammock adjacent to US 1 is a mature ecosystem and possesses good aesthetic value. Utilizing the wetlands and low value uplands with exotic vegetation for the disposal areas would conserve the aesthetics.

4.53. Temporary construction impacts would include some additional noise and air pollution while equipment completed the proposed project. Noise levels and air quality would be expected to return to pre construction conditions once the project has been completed.

4.54. Impacts of a more permanent nature would include the widening of the construction access easement through the temperate hardwood forest adjacent to US 1. Restricting the access road width to a single lane could reduce aesthetic impacts to this area. The construction of the dewatering/disposal on the wetlands and low value flatwoods would impact fewer aesthetic resources than the clearing of the mature flatwoods to the west.

4.55. Aesthetic Measures Plan. The concept of an aesthetic measure plan is to harmoniously blend the project into the setting. The aesthetic measures to counter construction impacts will be compatible with the project purpose and in no way compromise the safety, integrity, or function of the project.

4.56. Following completion of construction, the temporary disposal site will be restored to the original grade and turned over to the Volusia County Land Acquisition and Management

Department which will implement its revegetation plan as described in the Spruce Creek Preserve Management Plan.

4.57. The environmental setting with the proposed project construction should not adversely affect recreation resources. The proposed project endeavors to improve the aquatic habitat by dredging muck out of the bay and removing tidal flow restrictions to provide for improved flushing of the bay. Fishing within the bay could be improved with the constructed project. Flows into and out of the bay could be improved with the removal/reduction of the active U.S. 1 causeway abutments and the removal of the abandoned U.S. 1 causeway to the east of the active U.S. 1. Construction of the new U.S. 1 bridge could improve water access for larger recreational vessels to boat in the bay. An increase in the boat fishing could occur also. Dredged material dewatering and disposal details are still being finalized at this time. Temporary construction impacts may be experienced during construction operations. Once project construction has been completed recreation resources should return to pre construction conditions.

4.58. Threatened and Endangered Species. The U.S. Fish and Wildlife Service has evaluated the proposed removal of active and abandoned U.S. 1 causeways, dredging of Rose Bay, and use of adjacent uplands and wetlands for temporary spoil disposal operations, for potential adverse impacts to federally listed species, or destruction or adverse modification of critical habitat. The following comments are in accordance with Section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*). The Corps of Engineers and Fish and Wildlife Service have identified the Florida manatee, bald eagle, wood stork, piping plover, Atlantic salt marsh snake, green sea turtle, leatherback sea turtle, Atlantic ridley sea turtle and loggerhead sea turtle as possibly occurring within the project area.

4.59. Florida Manatee A 1982-1983 aerial survey of the Intracoastal Waterway reported relatively large numbers of manatees around Ponce de Leon Inlet and in the Halifax River. Other public sightings within the vicinity of the project area included Spruce Creek and Fozzard Creek. Spruce Creek was also considered an important source of freshwater. In addition, the ICW in Volusia County was the only segment of this waterway in northeastern Florida with significant amounts of readily available aquatic vegetation. Manatee use of the ICW in Volusia County during January, February, and March was extremely low. Manatee access to Rose Bay is greatly limited due to the extremely shallow depths throughout the preponderance of the embayment. From 1974 through 1999, 31 manatee carcasses have been recovered from estuarine waters extending 3 miles north and 6.5 miles south of the project area. (Florida Department of Environmental Protection 1999). Approximately 30% (9) of those mortalities were the result of collisions with watercraft, with another 45% the result of perinatal mortality. There have been no carcasses recovered from either north or south Rose Bay or in their immediate vicinity.

4.60. Bald Eagle. An active bald eagle nest (VO075) exists approximately 0.4 mile northwest of the F.E.C railroad trestle at the western end of Rose Bay (Florida Fish and Wildlife Conservation Commission 1999). This nest produced two offspring in both

1996 and 1997, and one offspring in 1998. One additional active nest occurs approximately 3 miles in the same direction as the closer nest. Foraging opportunities in Rose Bay are limited due to its extreme shallowness within the western two-thirds of the Bay.

4.61. Wood Stork. Wood storks typically nest in medium to tall trees located either in standing water, or on islands surrounded by relatively broad expanses of open water. They forage in a variety of open, shallow water habitats having relatively dense concentrations of appropriate-sized fish prey. These habitats include freshwater marshes, ponds, ditches, and depressions, tidal creeks and pools within salt marsh and mangrove forests, and managed mosquito impoundments. Wood storks use a wider variety of sites for roosting than nesting. These sites include cypress heads and swamps, pine or hardwood islands in marshes, and mangrove islands. Wood storks forage within the bay and intertidal creeks south of the bay. No nesting occurs within the vicinity of the project area.

4.62. Piping Plover. The piping plover winters along both the east and west coasts of Florida, where they are primarily associated with barrier beach systems. They occur on accreting ends of barrier islands and spits, at coastal inlets, and on low-lying barrier islands with overwash intertidal flats. The most frequented foraging habitats included sand and mud flats, sandy mudflats, lower beach or foreshore, and dredged spoil. Although there are no records of wintering plovers occurring within the project area, birds have been observed around Ponce de Leon Inlet.

4.63. Atlantic Salt Marsh Snake. The project area is within the range of the Atlantic salt marsh snake. Its historic range included Volusia, Brevard, and Indian River counties. Currently, this species appears restricted to a limited coastal strip in Volusia County. The Atlantic salt marsh snake inhabits coastal salt marshes and mangrove swamps, and has been observed feeding by day and at night along tidal creeks, ditches, and pools associated with glassworts and black mangrove. Aerial and ground surveys of potential habitat within Volusia County failed to find any snakes within the project area.

4.64. Sea Turtles. The occurrence of sea turtles within Rose Bay and the surrounding Spruce Creek estuary system is unknown. Sea turtles do nest on coastal beaches both north and south of Ponce de Leon Inlet. Juvenile green and loggerhead sea turtles are known to occur regularly within the Indian River Lagoon. Those occurring within Mosquito Lagoon may enter through Ponce Inlet. The other species appear to occur rarely within that system, with most records coming from the southern portion of the Lagoon around Sebastian Inlet. Juvenile green turtles are reported to feed on small invertebrates, while juvenile loggerheads feed mainly on crabs and mollusks, usually in shallow, hard-bottomed areas.

4.65. Because any potential sea turtle impacts from the proposed dredging would occur within open waters, consultation on these species is under the jurisdiction of the National Marine Fisheries Service.

4.66. Conclusions. Based on the description of the proposed project, and review of available information, the Fish and Wildlife Service concludes that the project is not likely to adversely affect any of the above listed species under Service jurisdiction. In order to minimize potential impacts to the Florida manatee and Atlantic salt marsh snake, however, the Service believes that the following recommendations should be incorporated into the project environmental planning.

4.67. Manatees.

- a. Standard manatee construction conditions.
- b. A requirement that all ships, vessels, boats and other watercraft associated with the dredging or causeway removal operations operate at slow speed/minimum wake at all times when within Rose Bay. Such watercraft shall comply with posted speeds when operating within speed zones designated in the Volusia County Manatee Protection Plan, or as otherwise posted.

4.68. Atlantic Salt Marsh Snake. Development of an Atlantic salt marsh snake protection/education plan for all construction personnel to follow. The plan shall be provided to the Service for review and approval at least 30 days prior to any spoil disposal clearing activities. The educational materials for the plan may consist of a combination of posters, videos, pamphlets, and lectures (*e.g.*, an observer trained to identify Atlantic salt marsh snakes could use the protection/education plan to instruct construction personnel before any spoil disposal activities occur). Informational signs should be posted throughout the construction site and contain the following information:

- a. Description of the Atlantic salt marsh snake, its habits, and protection under Federal Law;
- b. Instructions not to injure, harm, harass or kill this species;
- c. Directions to cease clearing activities and allow the Atlantic salt marsh snake sufficient time to move away from the site on its own before resuming spoil disposal; and,
- d. Telephone numbers of pertinent agencies to be contacted if a dead Atlantic saltmarsh snake is encountered. The dead specimen should be thoroughly soaked in water, then frozen.

4.69. Only an individual who has been either authorized by a section 10(a)(1)(A) permit issued by the Service, or designated as an agent of the State of Florida by the Florida Fish and Wildlife Conservation Commission for such activities, is permitted to come in contact with or relocate an Atlantic salt marsh snake. If necessary, Atlantic salt marsh snakes shall be held in captivity only long enough to transport them to a release site; at no time shall two snakes be kept in the same container during transportation.

4.70. An Atlantic salt marsh snake monitoring report must be submitted to the appropriate Florida Field Office within 60 days of the conclusion of clearing phases. The report should be submitted whether or not Atlantic salt marsh snakes are observed. The report should contain the following information:

- a. Any sightings of Atlantic salt marsh snakes;
- b. Summaries of any relocated snakes if relocation was approved for the project (e.g., locations of where and when they were found and relocated);
- c. Other obligations required by the Florida Fish and Wildlife Conservation Commission, as stipulated in the permit.

4.71. Hazardous, Toxic and Radioactive Wastes. A Phase I Environmental Site Assessment was conducted in conformance with the scope and limitations of ASTM Practice E 1527; of the proposed dredged material disposal site located in Volusia County, Florida. The site visit, conducted 13 May 1997, found the site to be free of hazardous and toxic materials and waste. In summary, the proposed dredged material disposal sites were found to be free of any hazardous or toxic waste problems.

4.72. Environmental Commitments:

State Water Quality Certification was obtained on June 25, 2002.

A cultural resources survey of the temporary upland disposal area will be conducted prior to construction. The results of the survey will be coordinated with the State Historic Preservation Officer.

All Endangered or Threatened Species requirements will be put into Plans and Specifications.

By coordinating this report, the proposed action is being coordinated with the National Marine Fisheries Service under the Magnuson-Stevens Fishery Conservation and Management Act for Essential Fish Habitat (EFH). The determination was made that EFH would not be adversely impacted by the proposed action and that no mitigation would be required.

5.0. Coordination.

5.1. The proposed action was coordinated with the U.S. Fish and Wildlife Service under the Fish and Wildlife Coordination Act and the Endangered Species Act. The proposed action has also been coordinated with the State Historic Preservation Officer under the National Historic Preservation Act of 1966, as amended. The proposed action will be coordinated with other appropriate Federal, State and local agencies and individuals.